

COLORED STONES

ASSIGNMENT 3

THE SOURCES OF GEMSTONES

IDENTIFICATION, PRODUCTION, MARKETING, BUYING



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I. TYPES OF DEPOSITS AND THEIR RELATIVE IMPORTANCE

During the study of the individual gemstones later in this course, all of the sources of each stone will be mentioned briefly. The purpose of this assignment is to show the relative importance both of different types of gem deposits and of the producing countries.

In contrast to the diamond industry, for which accurate figures are published regularly for almost every producing country, figures for colored-stone production are almost nonexistent. Those few that are available are far from reliable. The reasons for this are related to the average size of the mining operation in each of the important producing areas, plus the absence of a central buying and marketing organization such as that in the diamond industry. There are almost no colored-stone mining operations anywhere in the world that compare with even an average-size diamond mine. The tendency of the usual small operation is to conceal information on both production and sales figures. In addition, in many foreign countries there is a strong tendency to conceal production from government taxing authorities, with the result that total production can only be estimated. Most of the colored-stone mining areas are marginal and produce only when demand is high enough to yield a worthwhile price. Few colored stones could be produced, even under ideal conditions, in quantities that would make exploitation comparable to that of diamond feasible. Although the most important colored stones are in sufficient demand to keep mining a constant activity in the major districts, even the most important districts in the world contain these gemstones in concentrations too low to warrant large-scale exploitation in a high-cost country such as the United States.

By value, there is no question but that the most important sources of both colored stones and diamonds are the SECONDARY, or ALLUVIAL, deposits. Regardless of the mode of formation of the important gemstones, those that are tough withstand the rigors of transportation by streams from the original deposit and are concentrated in alluvial deposits. Some primary deposits furnish too low a yield of gem-quality material per ton of rock mined, or it is too difficult to mine, to permit commercially profitable mining, whereas nearby alluvial deposits may contain sufficient concentrations of gem rough to be operated to advantage. Of the primary types of colored-stone deposits, the most important is the pegmatite dike, followed in order by contact metamorphic deposits and vein deposits.

II. SOURCES

Although it is impossible to give production statistics for the world's colored-stone mining districts, it is not difficult to establish the relative importance of the major areas. The most important colored-stone localities in the world are the Mogok area of Burma, Sri Lanka (Ceylon), Brazil, the Malagasy Republic (Madagascar), and, more recently, East Africa. Each of these areas produces a number of different gemstones in significant quantities. The most important locality, Mogok, Burma, is one small area, whereas in the other countries production comes from fairly large areas.

At Mogok, impure limestones were intruded by molten rock and re-crystallized into marble. A variety of gem minerals resulted. Mogok was by far the most important producer of both rubies and sapphires. It also produced spinel, peridot, moonstone, zircon, quartz and a variety of rare gem minerals. Production has been effected from both primary deposits and river gravels. The major portion of the production today is from alluvial deposits. Burma is also the only important source of jadeite.

In Sri Lanka, under the current Communist regime, production has fallen significantly. Production is almost entirely from alluvial deposits. Very few primary deposits of any significance have been found. Occasionally, it is rumored that the Sri Lanka deposits are rapidly approaching exhaustion, but the country seems to continue to produce significant quantities of gemstones. Sri Lanka produces ruby, sapphire, spinel, the finest chrysoberyl (including cat's-eye and alexandrite), topaz, tourmaline, quartz, peridot, moonstone, garnet, zircon and a number of other gemstones.

Both primary and secondary deposits are gem sources in Brazil. In this country is found probably the greatest concentration of pegmatite dikes that exist anywhere in the world. In a huge shield of ancient crystalline rocks in Minas Gerais and surrounding states, these pegmatite dikes have produced enormous quantities of magnificently crystallized gem materials. The important gems produced in Brazil are beryl, amethyst, "topaz-quartz" (a misnomer), topaz, tourmaline, chrysoberyl and spodumene. Diamond is also found in alluvial deposits.

The Malagasy Republic (Madagascar) is also an area with a concentration of pegmatite dikes. Although its production is not as great as that of the other three countries, it has produced significant quantities of such important gemstones as beryl, topaz, tourmaline, quartz and kunzite.

In addition to Burma and Sri Lanka, Asia produces fine sapphires in the Kashmir area of India. The world's major source of zircon is in Cambodia. Some of the finest turquoise has been found in Iran (Persia), and much of the finest lapis-lazuli has come from Afghanistan. The Ural Mountains, dividing Russia and Siberia, have produced emeralds and a number of gems associated with pegmatite dikes. The finest pearls in the world come from the Persian Gulf, with perhaps the second most important source in the shallow sea between Sri Lanka and India. Fine nephrite jade is found in Western China.

Africa, of course, is noted primarily for its diamond production, although gem deposits of minor importance include emerald, grossular garnet, malachite and tiger's-eye. The principal diamond-producing countries are Zaire, Republic of South Africa, Ghana, Sierra Leone, South-West Africa, Angola, Tanzania and Central African Republic. Eastern Africa including Kenya, Tanzania, and Mozambique produce ruby, sapphire, "tanzanite," emerald, alexandrite, aquamarine, rhodolite and "tsavorite" garnets and tourmaline.

Important quantities of pearls are produced in the Tuamotu Archipelago

(Tahiti, etc.) and the East Indies. Australia is the world's major source of fine white and black opal, with the main deposits in South Australia. Queensland is the major source of black star sapphires and a prolific producer of dark-blue sapphires. Few other gem deposits of importance are to be found in this area.

The most important gem deposits in North America are the small scattered turquoise mines of the western United States, the pegmatite dikes of the Pala region, San Diego County, southern California, and the Maine tourmaline deposits. The California dikes have produce tourmaline, topaz, and the kunzite variety of spodumene in large quantities. Several of the mines in this area are still worked on a fairly regular basis. Other gem localities in North America include nephrite jade deposits, principally in Wyoming, Alaska, and British Columbia, but also in Oregon and California; labradorite from Labrador; fresh-water pearls from the Mississippi River and its tributaries; and sapphire from Montana. Pegmatite dikes in New England and North Carolina produce beryl and tourmaline, particularly. The numerous varieties of quartz are found in many localities throughout the continent.

The shores of the Baltic Sea, particularly in Germany, provide the major source of amber, although it is also found in Sicily and Roumania. Whitby, England, was the major source of jet. Quantities of pyrope garnet have been mined in Czechoslovakia (Bohemia), and pyrite in quantity comes from Spain. With these exceptions, Europe as a source of gem minerals has never been important.

Colombia, South America, is noted for the world's finest emeralds. Diamond is found in Venezuela and Guyana in small quantities.

The important gem-producing countries, together with the principal gems they produce, are listed below:

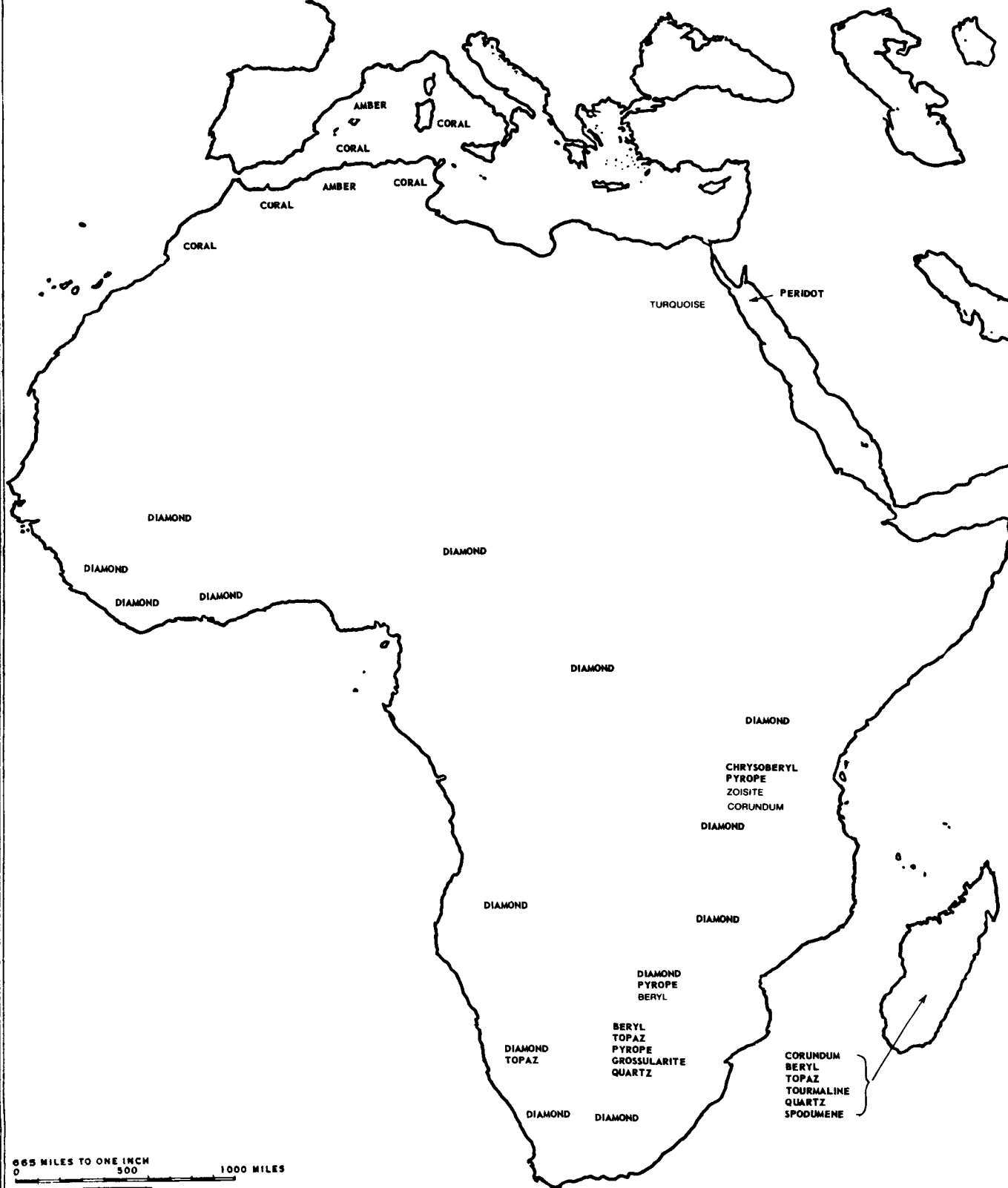
AFGHANISTAN	Lapis-lazuli.
ANGOLA	Diamond.
AUSTRALIA	Opal, sapphire, turquoise, chrysoprase.
BRAZIL	Diamond, beryl, topaz, tourmaline, quartz, chrysoberyl (cat's-eye), andradite garnet, andalusite, brazilianite, kunzite, corundum (sapphire).
BURMA	Ruby, sapphire, jadeite, spinel, peridot, zircon, moonstone, quartz.
COLOMBIA	Emerald, euclase.
CZECHOSLOVAKIA	Garnet, opal.
ENGLAND	Jet, quartz.
GERMANY	Amber.
GHANA	Diamond.
GUYANA	Diamond.
INDIA	Sapphire, garnet.

IRAN	Turquoise, pearl.
JAPAN	Cultured pearl.
KENYA	Garnet ("tsavorite"), rhodolite, corundum, emerald, alexandrite.
MALAGASY REPUBLIC . .	Beryl, tourmaline, kunzite, quartz, feld- spar, topaz.
PAKISTAN	Beryl.
REPUBLIC OF CENTRAL AFRICA . . .	Diamond.
REPUBLIC OF SOUTH AFRICA	Diamond.
RUSSIA	Emerald, alexandrite, demantoid garnet, tourmaline, feldspar, topaz, diamond.
SIERRA LEONE	Diamond.
SOUTH PACIFIC	Pearl.
SOUTH-WEST AFRICA . .	Diamond, tourmaline.
SRI LANKA	Corundum, chrysoberyl (cat's-eye and alexandrite), zircon, spinel, moonstone, pearl, garnet, peridot, tourmaline, topaz, quartz.
TANZANIA	Diamond, zoisite ("tanzanite"), grossular garnet ("tsavorite"), corundum.
THAILAND	Zircon, ruby, sapphire, spinel.
UNITED STATES	Nephrite jade, turquoise, garnet, peridot, quartz, beryl, tourmaline, corundum, feld- spar, fresh-water pearl, topaz, kunzite.
VENEZUELA	Diamond, pearl.
ZAIRE	Diamond, malachite.

The attached outline maps of the continents show the approximate sources of the principal gemstones. Because of the varied nature of deposits, the position of a name on a map sometimes indicates a general area from which the gemstone is mined and sometimes only a single mine. For example, the map of Africa contains many references to diamond. Particularly in South-West Africa, Ghana, Angola, Sierra Leone and Zaire, the diamonds are found in alluvial deposits and are therefore mined from fairly widespread areas. In Tanzania, on the other hand, the production is confined largely to one mine.

If desired, these maps can be studied more effectively by using an atlas and correlating the political boundaries and geographical names with the entries, thus locating the deposits more exactly. In preparing such maps, it is advantageous to remove boundaries and place names to give sufficient space for the gem names. It should be borne in mind that some of the deposits indicated are exceedingly important and that others are of more historical interest than of any present commercial significance.

(APPROXIMATE SOURCES OF PRINCIPAL GEMSTONES)





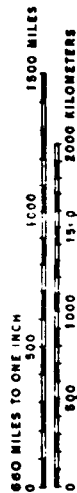
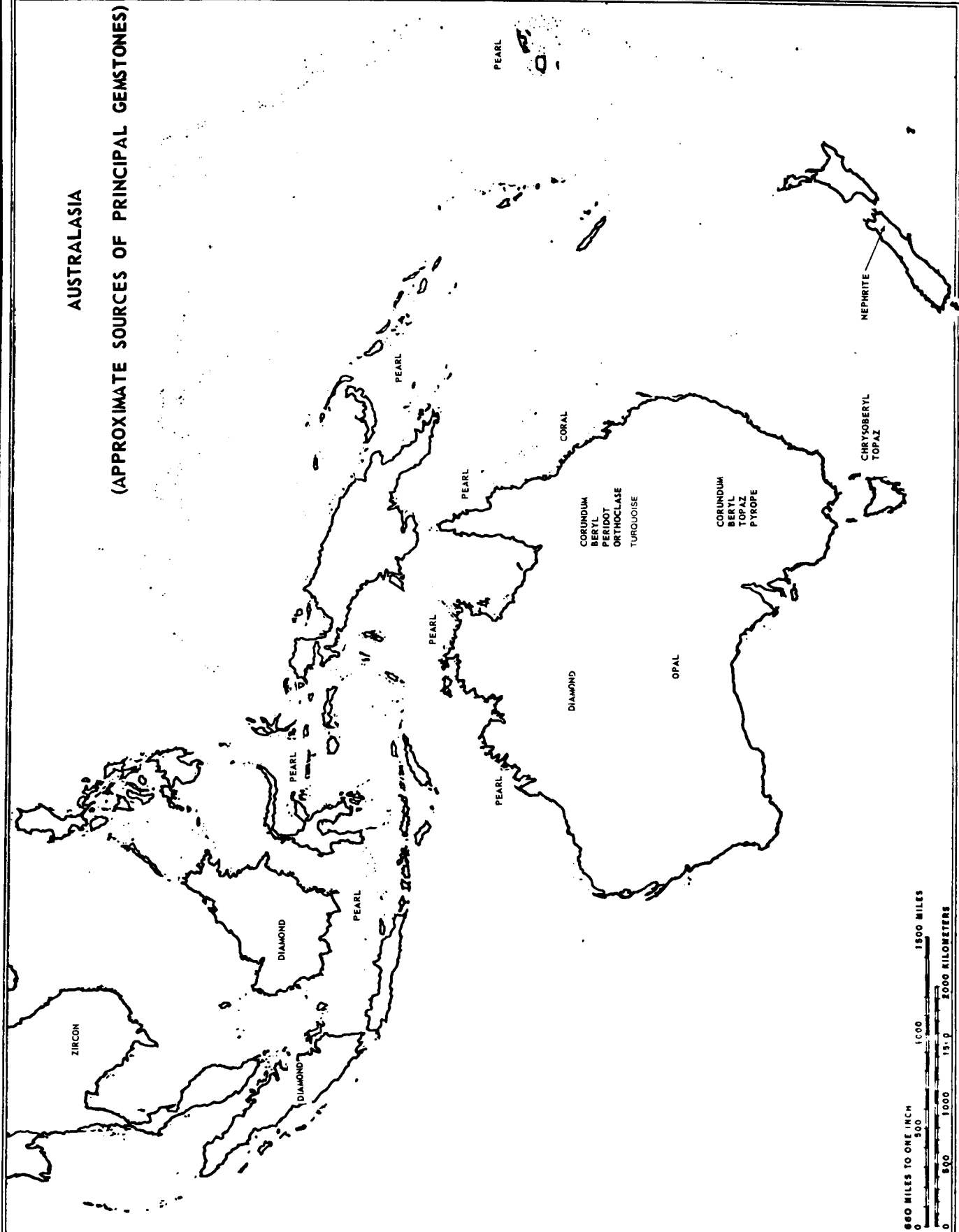


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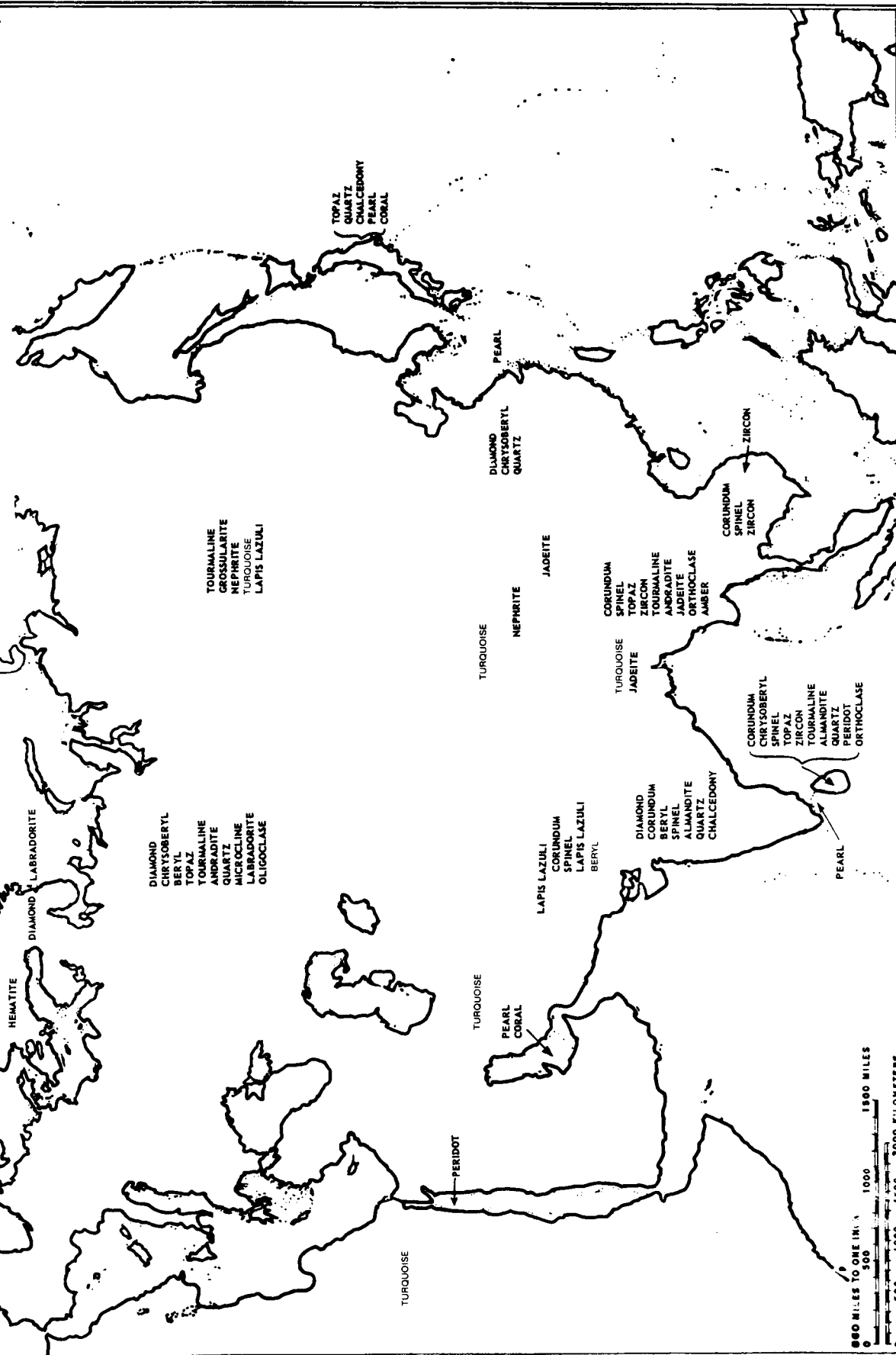
AUSTRALASIA

(APPROXIMATE SOURCES OF PRINCIPAL GEMSTONES)



ASIA

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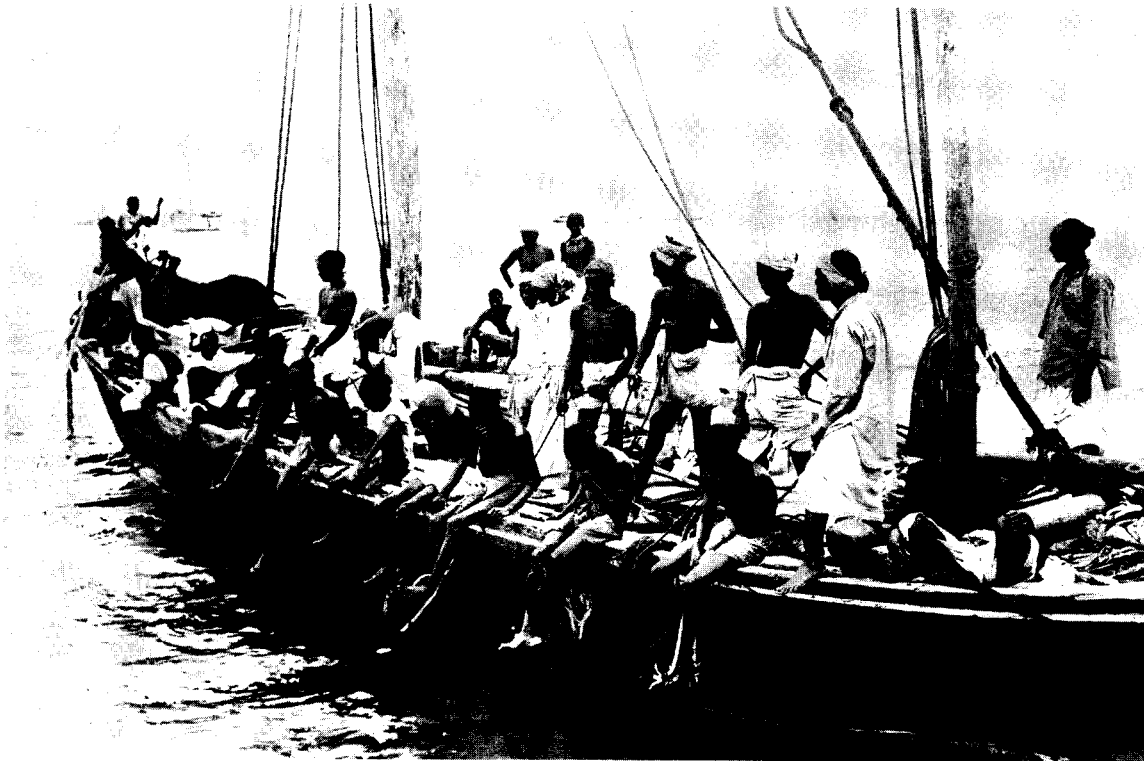


SOURCES OF GEMSTONES



Pearl Diving in Sri Lanka

(Courtesy Julius Raunheim Co.)



SOURCES OF GEMSTONES

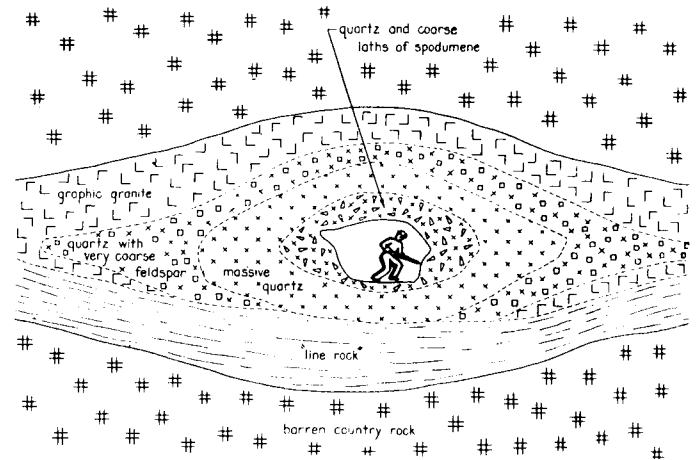
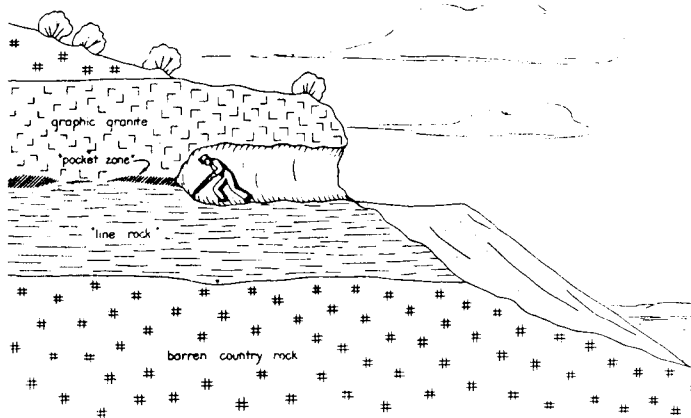


Opal Mining in Australia

(Courtesy Australian Dept. of Information)



SOURCES OF GEMSTONES



Mining Pegmatites in Southern California

(Courtesy Dr. Richard H. Jahns)



Gem Mining in Brazil

(Courtesy Thomas Draper)

SOURCES OF GEMSTONES



Gem Mining at Mogok, Burma

(Courtesy Martin Ehrmann)

III. MINING COLORED STONES

Gemstones found in river gravels are usually heavier than the average of the materials making up the gravel. For this reason it is possible to use methods similar to those used in panning gold. Ruby, for example, is considerably denser than most of the components of the gem gravels. Panning consists of rapidly swirling a mixture of gravel and water in a broad, shallow pan, allowing the lighter gravel particles to escape over the edge of the pan and leaving the heavier materials and concentrate of ruby and sapphire in the residue. In Burma, Sri Lanka, India, Thailand (Siam) and parts of Ghana, gravels are often collected in baskets by native laborers who carry the baskets to the nearest water and, with simple panning methods, concentrate the heavier materials from which rough gemstones are selected by hand picking.

Slightly more advanced methods are sometimes used in certain deposits in a number of the countries just mentioned, where the same operation is accomplished by power or hand-operated rockers that do the panning mechanically. Sometimes the streams are dammed and sent through a sluice to effect this purpose. In general, the actual mining of the gravel is accomplished by hand methods. However, in a few of the larger alluvial diamond deposits that yield a sufficient number of stones to warrant the cost, power shovels and other modern earth-moving machinery are used to effect greater production and mechanization of the concentration process to increase the yield.

The mining of pegmatite dikes requires drilling and blasting in order to find the pockets in which gem crystals are concentrated. In contrast to the mining of diamonds in blueground, the danger of breaking gem crystals by blasting is great. Thus, once the pockets are located, the miner must proceed with great caution to avoid destroying the gemstones he is seeking. Skilled miners learn quickly to recognize the indications that suggest the proximity of a pocket, and from that point they work as much by hand as possible. In primitive areas the drilling done to set the explosive charges is accomplished by hand, whereas more modern mining is done with air drills of a type used in metal mining.

The recovery of opal in Australia differs somewhat from the methods described thus far, since it is impossible to determine even the approximate localities where deposits might be encountered. The areas where most of the opal has been recovered to date are flat plains similar to much of the desert country in the southwestern part of the United States. Prospectors merely choose a spot at random and dig a hole or shaft at depths ranging from 10 to 20 feet. If none of the "opal seams" are encountered, they move to another spot and repeat the operation. The working conditions in many of these areas are unbearable in the summer months, due to the extreme heat and lack of sufficient water.

Demand for most of the colored stones is sufficiently sporadic and uncertain that continuous mining is rarely feasible. As a result, there is

often a wide fluctuation in the quantities available on the market. A good example of this situation is the peridot market. Apparently, the major source of peridot, the Island of Zebriget (or St. Johns) in the Red Sea, is not approaching exhaustion, yet at times it is difficult to locate large, fine peridots on the market. When the demand seems to be sufficiently great to make the price attractive, mining is undertaken and the supply is good for a period. The same situation exists for a number of the colored stones.

Fluctuations of availability also take place when known sources are worked out. Black opal was not available prior to the discovery of the Lightning Ridge deposit in Australia. Since this deposit is virtually exhausted, new material has practically disappeared from the market and will not become readily available until such time as a new deposit of significance is discovered. This situation also holds true frequently for other gemstones.

Another condition exists for such stones as jet and amber, which are subject to wide fluctuations of demand. Plentiful sources are available, but they are worked only when demand is sufficient to warrant exploitation. The most important emerald mines of Colombia, which are owned by the Government, are reopened sporadically whenever the quantity on hand has been sold out at prices the Government considers sufficient. Presently, the Government has mines up for lease.